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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte HISAO HAYASHI, MASAHIRO FUJINO, YASUSHI
SHIMOGAICHI, and MAKOTO TAKATOKU

Appeal 2009-003171
Application 09/772,986
Technology Center 2800

Decided: September 23, 2009

Before JOSEPH F. RUGGIERO, LANCE LEONARD BARRY, and
HOWARD B. BLANKENSHIP, *Administrative Patent Judges*.

RUGGIERO, *Administrative Patent Judge*.

DECISION ON APPEAL

STATEMENT OF THE CASE

Appellants appeal under 35 U.S.C. § 134 from the Final Rejection of claims 17-36, which are all of the pending claims. Claims 1-16 have been

canceled. An oral hearing was conducted on this appeal on September 15, 2009. We have jurisdiction under 35 U.S.C. § 6(b).

We affirm.

Rather than reiterate the arguments of Appellants and the Examiner, reference is made to the Brief (filed February 27, 2008), the Answer (mailed May 14, 2008), and the Reply Brief (filed July 10, 2008) for the respective details. Only those arguments actually made by Appellants have been considered in this decision. Arguments which Appellants could have made but chose not to make in the Briefs have not been considered and are deemed to be waived. *See* 37 C.F.R. § 41.37(c)(1)(vii).

Appellants' Invention

Appellants' invention relates to a thin film semiconductor device formed as integrated circuits on an insulating substrate with bottom gate structured thin film transistors. The bottom gate structure has a gate electrode, a gate insulating film, and a semiconductor thin film stacked in the order from below upward. The gate insulating film has a thickness greater than the thickness of the gate electrode. (*See generally* Spec. 6:6-20 and 9:28-10:13).

Claim 17 is illustrative of the invention and reads as follows:

17. A thin film semiconductor device comprising:
a gate electrode in contact with an insulating substrate;
a gate insulating film in contact with a gate electrode, said gate electrode being between said insulating substrate and said gate insulating film,

wherein a thickness of said gate insulating film is greater than a thickness of said gate electrode.

The Examiner's Rejections

The Examiner's Answer cites the following prior art references:

Colgan	US 5,912,506	Jun. 15, 1999
Seiki	US 6,235,561 B1	May 22, 2001 (filed Jul. 13, 1998)
Hisao (as translated) (Published Japanese Patent Application)	JP 10-209467	Aug. 7, 1998

Claims 17-27 and 36 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Hisao.

Claims 28-32 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Hisao in view of Colgan.

Claims 31-35 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Hisao in view of Seiki.

ISSUE

The pivotal issue before us is whether Appellants have demonstrated that the Examiner erred in determining the obviousness to the ordinarily skilled artisan of selecting the smallest possible thickness values disclosed by Hisao for the gate insulating film and the gate electrode to thereby result in a semiconductor device structure in which the gate insulating film thickness is *greater than* the gate electrode thickness.

FINDINGS OF FACT

The record supports the following relevant findings of fact (FF) by a preponderance of the evidence:

1. Hisao discloses (Fig. 1, ¶ [0011]) a thin film semiconductor device including a gate electrode 5 in contact with an insulating substrate 1, a gate insulating film 4 in contact with the gate electrode, and the gate electrode 4 being between the insulating substrate 1 and the gate insulating film 4.
2. Hisao further discloses (¶ [0012]) the gate electrode 5 has an upper layer 5a with a thickness of “around 50 to 300 nm,” and a lower layer 5b with a thickness of “50 to 200 nm.”
3. The thickness of the gate insulating film 4 is disclosed by Hisao (¶ [0016]) as having a thickness of “100 to 200 nm.”
4. The Figure 1 drawing of Hisao illustrates the thickness of the gate insulating film 4 as being greater than the thickness of the gate electrode 5.

PRINCIPLES OF LAW

In rejecting claims under 35 U.S.C. § 103, it is incumbent upon the Examiner to establish a factual basis to support the legal conclusion of obviousness. *See In re Fine*, 837 F.2d 1071, 1073 (Fed. Cir. 1988). In so doing, the Examiner must make the factual determinations set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 17 (1966) (stating that 35 U.S.C. § 103 leads to three basic factual inquiries: the scope and content of the prior art, the differences between the prior art and the claims at issue, and the level of ordinary skill in the art). “[T]he examiner bears the initial burden, on review of the prior art or on any other ground, of presenting a *prima facie*

case of unpatentability.” *In re Oetiker*, 977 F.2d 1443, 1445 (Fed. Cir. 1992). Furthermore,

‘there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness’ . . . [H]owever, the analysis need not seek out precise teachings directed to the specific subject matter of the challenged claim, for a court can take account of the inferences and creative steps that a person of ordinary skill in the art would employ.

KSR Int’l Co. v. Teleflex Inc., 550 U.S. 398, 418 (2007) (quoting *In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006)).

ANALYSIS

I. The rejection of claims 17-27 and 36 based on Hisao.

With respect to the Examiner’s obviousness rejection of representative independent claim 17 based on Hisao, Appellants’ arguments in response assert a failure by the Examiner to establish a prima facie case of obviousness since all of the claimed limitations are not taught or suggested by the applied Hisao reference.¹ Appellants’ arguments focus on the contention (App. Br. 6-12; Reply Br. 3-4) that, in contrast to the requirements of claim 17, Hisao does not provide a teaching of a semiconductor device having an insulator layer with a thickness *greater than* the thickness of the gate electrode. According to Appellants, even if the ordinarily skilled artisan would have selected the smallest thickness values

¹ Appellants argue rejected claims 17-27 and 36 together as a group. *See* App. Br. 5. Accordingly, we select claim 17 as representative. *See* 37 C.F.R. § 41.37(c)(1)(vii).

taught by Hisao for the insulator layer 4 and the gate electrode 5, i.e., 100 nm, the result would be that the insulator layer thickness would be *equal* to the gate electrode thickness, not *greater than* as claimed.

We do not find Appellants' arguments to be persuasive of any error in the Examiner's stated position. We agree with the Examiner's finding (Ans. 7-8) that Hisao's disclosure of an upper gate electrode layer 5a with a thickness of "around 50 to 300 nm" (FF 2) together with a lower gate electrode layer 5b with a disclosed thickness of 50-200 nm (FF 3) would result in a combined gate electrode thickness of "about 100-500 nm." We further agree with the Examiner (*id.*) that Hisao's disclosed lower limit gate electrode thickness of "about 100 nm" allows for values slightly below 100 nm. See *In re Woodruff*, 919 F.2d 1575, 1577 (Fed. Cir. 1990).

With the above discussion in mind, we find no error in the Examiner's articulated line of reasoning (Ans. 9-10) which concludes that, since the ordinarily skilled artisan would desire to make the semiconductor structure of Hisao as small as possible, the smallest disclosed thickness values for the gate electrode, i.e., slightly below 100 nm, and the gate insulator, i.e., 100 nm, would be selected. "[W]here the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation." *In re Aller*, 220 F.2d 454, 456, (CCPA 1955). Accordingly, the resultant structure would have an insulator layer 4 with a thickness *greater than* the gate electrode thickness as claimed.

We further find that, as recognized by Appellants (App. Br. 8), Hisao discloses ranges of thickness values of the insulator layer 4 and gate electrode 5 which overlap the claimed range. It is well settled that a *prima*

facie case of obviousness exists when a claimed range overlaps the ranges disclosed in the prior art. See *In re Geisler*, 116 F.3d 1465, 1469 (Fed. Cir. 1997), *In re Woodruff*, 919 F.2d 1575, 1578, (CCPA 1976), *In re Malagari*, 499 F.2d 1297, 1303 (CCPA 1974).

A prima facie case of obviousness based on overlapping ranges can be rebutted by an indication of the criticality of the claimed range such as by a showing of unexpected results relative to the prior art range. *In re Woodruff*, 919 F.2d at 1578. In the present case, however, we do not find that Appellants (App. Br. 3-4; Reply Br. 1-2) have established either in the disclosure of the invention or the presented arguments, that the particular claimed thickness range wherein the gate insulating film thickness is *greater than* the gate electrode thickness is critical or produces unexpected results over the prior art overlapping thickness ranges for the gate insulating film and gate electrode.

While Appellants (App. Br. 10-12; Reply Br. 4-6) point to the disclosure at page 9, line 22 through page 10, line 13 of the Specification as providing comparative data as evidence of unexpected results of the claimed thickness range, we agree with the Examiner (Ans. 11) that no such comparative data has been presented. Further, we agree with the Examiner (*id.*), that the graphs illustrated in Appellants' Figures 3 and 4 show no criticality of a gate electrode thickness value that is below the 100 nm disclosed lower limit value for the gate insulator film. Even further, we find Appellants' disclosure (Spec. 6:30-31) that the thickness of the gate insulating film is "preferably" greater than the gate electrode thickness belies the criticality of the claimed range.

Lastly, we agree with the Examiner (Ans. 8) that, Appellants arguments (App. Br. 7; Reply Br. 2) to the contrary notwithstanding, the Figure 1 illustration of Hisao, which unambiguously shows the thickness of gate insulating film 4 being greater than the thickness of the gate electrode 5 (FF 4), provides further evidence which buttresses the Examiner's conclusion as to the obviousness of making the gate insulating film thickness greater than the gate electrode thickness. It is well settled that the drawings of a prior art disclosure must be evaluated for what they reasonably disclose to one of ordinary skill. *See In re Aslanian*, 590 F.2d 911, 914 (CCPA 1979).

For the above reasons, since it is our opinion that the Examiner has established a prima facie case of obviousness which has not been overcome by any convincing arguments from Appellants, the Examiner's 35 U.S.C. § 103(a) rejection of representative independent claim 17, as well as dependent claims 18-27 and 36 not separately argued by Appellants, is sustained.

II. The rejection of claims 28-32 based on the combination of Hisao and Colgan.

This rejection is sustained as well. We find no error in the Examiner's application (Ans. 5-6) of the aluminum and molybdenum material teachings of Colgan (Fig. 7, col. 4, ll. 29-65) to the semiconductor device structure disclosure of Hisao. Appellants' arguments (App. Br. 12-13; Reply Br. 6) rely on the arguments asserted previously against the Examiner's rejection of independent claim 17, which arguments we found to be unpersuasive for all of the previously discussed reasons.

III. The rejection of claims 31-35 based on the combination of Hisao and Seiki.

We also sustain this rejection in which the Examiner applied the gate electrode material teachings of Seiki (col. 1, ll. 28-33 and col. 5, ll. 49-52) to Hisao. As with the Hisao/Colgan combination, Appellants' arguments (App. Br. 13; Reply Br. 6) rely on the unpersuasive arguments asserted previously against the Examiner's rejection of independent claim 17.

CONCLUSION OF LAW

Based on the findings of facts and analysis above, we conclude that Appellants have not shown that the Examiner erred in rejecting appealed claims 17-36 for obviousness under 35 U.S.C. § 103.

DECISION

The Examiner's 35 U.S.C. § 103 rejection of claims 17-36, all of the appealed claims, is affirmed.

No time period for taking any subsequent action in connection with this appeal may be extended under 37 C.F.R. § 1.136(a)(1)(iv).

AFFIRMED

Appeal 2009-003171
Application 09/772,986

gvw

RADER, FISHMAN & GRAUER, PLLC
1233 20TH STREET NW
SUITE 501
WASHINGTON, DC 20036